DOCUMENT RESUME

ED 190 085 IR 008 566

AUTHOR Pitlak, Robert T.
TITLE Online Data Searching as a Tool for Motivating Innovation.
PUB DATE Mar 80
NOTE 15p.: Paper presented at the National Online Information Meeting (New York, NY, March 25-27, 1980).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Administrators; *Creativity Research; Industry; *Information Retrieval; *Innovation; Motivation; *Motivation Techniques; *Online Systems; Professional Personnel; Stimulation; Technology

ABSTRACT

A study was conducted to test the contention--which is supported by a review of the literature--that access to a wide variety of ideas and novelty will tend to stimulate innovation. The experiment consisted of a study of attitude changes through pre- and post-test administration of a research questionnaire to a group of 20 voluntary participants from a small high technology company before and after a 60-day period of exposure to online searching. Evaluation using standard statistical tests indicated that a statistically significant increase in perceived level of innovation occurred after the subject's exposure to online data searching. In addition, a direct and positive relationship between the perceived level of new idea generation and the frequency of online searching was observed. A list of 14 references is appended. (Author/RAA)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED190085

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

ONLINE DATA SEARCHING AS A TOOL FOR MOTIVATING INNOVATION

BY

Robert T. Pitlak

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Robert T. Pitlak

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

IR008926

ONLINE DATA SEARCHING AS A TOOL FOR MOTIVATING INNOVATION

ABSTRACT

A review of the literature supports the contention that access to a wide variety of ideas and novelty, both inherent in the online technique, will tend to stimulate innovation. To test this contention, a statistical study was made of attitude changes, through pre- and post-test administration of a research questionnaire.

The significance of the responses of a group of twenty voluntary participants from a small, high-technology company, made before and after a sixty day period of exposure to online searching, was evaluated using standard statistical tests. The results indicated that a statistically significant increase in perceived level of innovation occurred after the subjects' exposure to online data searching. In addition, a direct and positive relationship between the perceived level of new idea generation and the frequency of use of online searching was observed.

The nature of this experiment may limit its applicability to other situations. However, the experiment did clearly indicate that, at least in this specific situation, online searching represents a potential technique for motivating innovation. It is recommended that this area warrants further research.

5.7

ONLINE DATA SEARCHING AS A TOOL FOR MOTIVATING INNOVATION

Robert T. Pitlak

INTRODUCTION

The survival of a business in a complex, rapidly changing market, depends not only on its technical competence, but on its ability to anticipate changes and respond rapidly to them. This in turn places a premium on innovation by personnel within all functional disciplines in the organization. Assuming that innovation depends largely on individual creativity, many of the conditions required to facilitate it are well documented.[1]

One of these conditions, the exposure to a wide variety of ideas, is an area in which online data searching seems to offer some promise. Not only does this technique provide fast access to a large number of data bases covering a wide range of subjects,[2] but involves a man-computer interface which, in itself, forces a certain amount of discipline, causing the user to think about his problem with clarity and precision.[3]

These considerations seem to suggest that online data searching may offer an effective mechanism for encouraging motivation. To test the validity of this suggestion, an experiment was performed.[4] This experiment, a statistical study of attitude changes after a period of exposure to the online searching technique, showed a significant increase in the perceived levels of innovation after the exposure, as well as a significant relationship between the number of new ideas generated and the frequency of use of the online searching facility.

The experiment was limited to a group of volunteers from a small, high technology company. This may limit its applicability to other situations. The results, however, seem to justify additional experimentation.

REVIEW OF THE LITERATURE

Prior studies of the use of online data searching to encourage innovation are scarce, if they exist at all. Donald Hawkins has produced a permuted title index covering more than a thousand articles concerning online bibliographic and numeric systems published since 1965.[5] Examination of this index and its first update reveals that the words "creativity,""innovation," or "motivation" do not appear within the titles of any of the articles included. Still, a search of the literature produced ample evidence to support the contention that access to a wide variety of ideas, inherent in the online search technique, would tend to stimulate innovation.

The wealth of available literature dealing with innovation or creativity is indicative of the complexity of this subject area. Even an attempt to simply define innovation or creativity points to a surprising lack of agreement. Taylor,[6] for example, has discussed a large number of seemingly acceptable definitions. Kline[7] has shown that a group of qualified observers had difficulty in identifying creative acts. For this reason, no attempt was made to judge whether specific acts were truly creative. Instead, the experiment described in this report relied on the subjects' own perceptions of creativity or innovation.

Much of the literature dealing with creativity centers on methodologies designed to facilitate creative problem solving. Graham Wallas, one of the earliest theorists in this area, deduced that creative thinking progressed through several distinct stages.[8] He observed that most creative ideas were preceded by a long period of conscious effort, but generally arrived unexpectedly, when the mind was no longer engaged in this thought process. From this, he concluded that there must be an unconscious, incubation period between the conscious effort and the emergence of the idea.

Alex Osborne, the developer of the well-known "Brainstorming" technique, reasoned that the analytical and creative aspects of the mind are generally in opposition.[9] Therefore, his technique for stimulating creative problem solving was to divide the effort into two stages, prohibiting analysis during the idea-generation stage.

William Gordon introduced another technique called "Synectics" which encouraged speculation and unconventional viewpoints.[10] This technique makes wide use of analogies in an effort to alter one's normal perception of things.

One of the characteristics inherent in most of these methodologies is the attempt to produce creative ideas from some combination of other, perhaps unrelated thoughts. Indeed, Dellas and Gaier have concluded that openness to external stimuli and wide range of interests are two of the distinctive personality traits of creative individuals.[11] Thus, it may be argued that innovation is more likely to emerge when a large variety of ideas is

available, a concept which is central to the experiment reported in this paper.

James Prattis conducted an interesting study of risk strategy,[12] a factor which is generally present in creative activity. He demonstrated that tolerance for high risk increases as more information becomes available. To this extent, the study supports the contention that the higher level of information which can be made available through online searching would tend to encourage innovation.

Carl Rogers' concept of "self-actualization" as a motive for creativity is well accepted. Rogers sees the creative individual as one who needs to maximize his own potential capabilities.[13] Online searching, with its capacity for reaching a variety of ideas on a wide range of subjects, from numerous sources, can be viewed as a tool which a company can use to facilitate the self-actualization of its employees.

THE EXPERIMENT

The research project was essentially a statistical study of attitude changes in a group of twenty participants, through pre- and post-test administration of a research questionnaire. Because all participants came from the same small company and knew each other, as well as the researcher, responses were made anonymously. Matched pairing of pre- and post-test responses was made possible by assigning a random, unrecorded number to each participant.

The group constituted a reasonable cross-section of the company, with participation by members of such organizational units as engineering, sales, marketing, production, administration

and accounting. Members of the group had been employed by the company for periods ranging from one to ten years, with a mean employment of just over four years.

Three hypotheses were selected for study, stated as follows:

(1) Personnel using online searching will perceive an improvement in level of innovation.

(2) There will be a significant increase in the search for and use of reference material by personnel after training in and use of online data searching.

(3) Personnel using online searching will perceive an increase in the generation of new ideas, stimulated by use of this technique.

The first hypothesis was, of course, the key to the study. The second was drawn primarily to verify that the use of the online technique was actually being accepted by the group. Finally, while the first hypothesis was essentially qualitative in nature, the third represented an attempt to relate the perception of innovation to the actual use of online searching on a quantitative basis. Thus, the third hypothesis constituted a safeguard against group effects such as the classic "Hawthorne effect."[14]

The pre-test questionnaire was administered prior to training the group in elementary techniques of online data searching. At this point, no member of the group had had prior experience in this area. The post-test questionnaire was administered sixty days after an online searching terminal had been made available for use by the group.

The first hyposthesis was tested with a series of questions attempting to measure the degree of agreement with statements related to suggested levels of innovation in the company, the department, and the individual as well as the perceived level of

innovation of the same three organizational elements on a rating scale. Examples are as follows:

Compared to similar companies, I think this one is at least as innovative. (Check one)

___Strongly agree
___Agree
___Mildly agree
___Slightly disagree
___Disagree
___Strongly disagree

Compared to other individuals, I think I am

___Not as innovative
___Slightly less innovative
___About as innovative
___More innovative
___Significantly more innovative
___Much more innovative

Such multiple-choice responses provide for quick-and-easy completion of the questionnaire, but result in simple ordinal data which limit the analytical tools which may be applied. In view of the small sample size available, the respondents were asked to complete a secondary instrument in which they assigned continuous-scale, numerical values to the choices permitted in the primary questionnaire. With these values available, the ordinal data supplied by the original questions were transformed to a Thurstone-like scale, representing nearly interval scale data. The advantage of this approach was that the strength of the analysis was greatly improved without requiring the respondents to make a large number of numerically weighted responses.

The significance of changes in responses to these questions was examined by means of the Sign test, the Wilcoxon Matched-Pairs test, and, after collapsing the two sets of answers into a

one-sample set of differences, the t-test. Thus, three different measures, all suitable for small samples, were employed.

The second hypothesis was tested by examining the company's records of requests for copies of articles, reports, etc., during the test period as well as during an eighteen month period preceding the experiment. The data during the eighteen month period was assumed to have a normal distribution. The probability of the result during the test period being a part of this same distribution was computed.

The third hypothesis was tested with questions in which the respondents estimated the number of new ideas which had been generated, by the individual respondent as well as the rest of the company, during a three month period preceding the completion of the questionnaire. Finally, as part of the post-test administration, the respondents were asked to estimate the number of searches they made during the experimental period. The significance of changes in the perceived number of new ideas generated was examined with the t-test. The relationship between these and the number of searches made was examined by computing the product-moment coefficient of correlation and administering the t-test.

RESULTS

The questionnaire, in attempting to measure changes in perceived level of innovation, used seperated sets of questions dealing with the individual, his department, and the company as a whole. The results were not completely consistent across these three organizational units.

The results with respect to the individual's level of innovation were ambiguous, showing an increase, statistically significant at the 0.05 level, with the question using a rating scale, but an increase which did not reach statistical significance with the question using degrees of agreement. This ambiguity, however, is very likely due to a fault in the questionnaire. As illustrated in Figure 1. a full thirty percent of the participants had selected the highest level of agreement during the pretest phase. It was, therefore, impossible for these participants to register any increase during the post-test administration.

Questions dealing with the perceived level of innovation at the department level showed an increase, but failed to reach a level of statistical significance. In view of the results at the individual and company levels, this result is puzzling. Two possible explanations do, however, come to mind. It is possible that the result is caused by the respondents' confused attitude toward a department which is often ill-defined in small companies. On the other hand, it is possible that the subjects' responses are distorted by a sense of competition with others in the same departments.

The questions dealing with the perceived level of innovation at the company level showed a consistent increase which was clearly significant at the 0.05 level.

Examination of company records of requests for literature showed an increase in both the number of requests and the number of people making requests during the test period. However, the

Figure 1.

Pre- and Post-Test Scores in Response to Question "Compared to other individuals, I think I am at least as innovative"

(Key: SA=Strongly Agree; A=Agree; MA=Mildly Agree; SL= Slightly Disagree; D=Disagree; SD=Strongly Disagree)

	Pre-Test		Post-Test		Difference	
Subject	Response	Weight	Response	Weight	Sign	Weight
1	SA	132	SA	132	0	0
2	SA	132	SA	132	0	0
3	MA	88	A	98	+	10
4	SA	132	SA	132	0	0
5	A	98	A	98	0	0
6	A	98	A	98	0	0
7	A	98	A	98	0	0
8	MA	88	MA	88	0	0
9	MA	88	A	98	+	10
10	A	98	A	98	0	0
11	MA	88	A	98	+	10
12	MA	88	A	98	+	10
13	A	98	MA	88	-	-10
14	A	98	A	98	0	0
15	MA	88	A	98	+	10
16	A	98	A	98	0	0
17	SA	132	SA	132	0	0
18	SA	132	SA	132	0	0
19	SA	132	SA	132	0	0
20	A	98	A	98	0	0

Sign Test: n=6; x=1; p=0.5; $p(x \leq 1)=0.109$**
Wilcoxon Test: n=6; T=3.5**
t-Test: d.f.=19; t=1.710**; p(t)=0.052**

**Not Statistically Significant

data on such requests during the eighteen months preceding the study were rather crude and exhibited an unexpectedly high standard deviation. As a result, the observed increases failed to reach a level which would statistically support the hypothesis regarding the use of reference materials.

The questions dealing with the perceived number of new ideas generated produced what is probably the clearest link between the use of online searching and the level of innovation. Responses showed increased perception of new ideas by the individual and within the rest of the company, both significant at the 0.05 level. Furthermore, calculation of the product-moment correlation coefficient showed a direct relationship between the perceived increase and the number of searches made during the course of the experiment. These coefficients were 0.9 and 0.6 for the individual and company, respectively. Both relationships were found, by means of the t-test, to be significant at the 0.05 level.

CONCLUSIONS

It would be naive to expect a limited experiment, performed on a small group within one specific company to prove a relationship between online data searching and the level of innovation within the company. The results of this experiment do, however, seem to at least point in this direction.

Most of the limitations inherent in this study can be traced to the small scale of the experiment. The results would certainly appear to be more significant were they extended to a larger sample

perhaps from a larger company or a group of similar companies.

Certainly, the questions used in the research instrument require some improvement. Questions which effectively limit the ability of the respondent to indicate changes in attitude should be eliminated. The significance of the concept of the "department" should be reviewed.

Finally, the significance of the failure of this experiment to support the hypothesis that an increased use of reference materials would be observed, should be explored further. Perhaps an alternate method for verifying group acceptance of the online technique should be employed. Perhaps a larger sample will provide data with less deviation and allow acceptance of the hypothesis. On the other hand, the failure to support the hypothesis may be real. That is, perhaps the training given by the researcher was not adequate to instill confidence in the use of the online technique by the subjects involved, and professional training is required.

In spite of the limitations of this study, the results are encouraging. The experiment did, in fact, produce at least some evidence of a direct and significant relationship between the perceived level of innovation within the company studied and the use of the online search technique. It is hoped that this evidence is sufficient to encourage others to pursue research in this area in the future.

REFERENCES

1. Morris I. Stein and Shirley J. Heinze, Creativity and the Individual (Glencoe, Illinois: Free Press, 1960); Gary A. Steiner (ed.), The Creative Organization (Chicago: University of Chicago Press, 1965).

2. "Data Bases Online," On-Line Review, II,1 (March, 1978), 15; "Nonbibliographic Databases Online," On-Line Review, II, 2 (June, 1978), 125.

3. Gilbert Burck, "The Boundless Age of the Computer," Fortune, LXIX. 2 (March, 1964), 101.

4. Robert T. Pitlak, Effectiveness of On-Line Data Searching for Encouraging Innovation within a Small, High-Technology Company, unpublished M.B.A. research project, Pepperdine University, 1979.

5. Donald T. Hawkins, "On-Line Information Retrieval Bibliography, 1965-1976," On-Line Review, I, 1 (March, 1977), Supplement, S1-1 to S1-20; "On-Line Information Retrieval Bibliography, On-Line Review, II, 1 (March, 1978), 63-106.

6. Irving A. Taylor, "The Nature of the Creative Process," in Peter G. Smith (ed.) Creativity. New York: Hastings House, 1959.

7. James A. Kline, Creativity: Product, Person, Potential and Motivation, unpublished doctoral dissertation, University of Colorado, 1969.

8. Graham Wallas, The Art of Thought (New York: Harcourt, 1926).

9. Alex F. Osborne, Applied Imagination (New York: Scribners, 1953).

10. William J. J. Gordon, Synectics: The Development of Creative Capacity (New York: Harper, 1961).

11. Marie Dellas and Eugene L. Gaier, "Identification of Creativity: The Individual," Psychological Bulletin, LXXIII, 1 (January, 1970) 55-73.

12. James I. Prattis, "Gambling, Fishing, and Innovation--A Cross Situational Study of Decision Making," Journal of Comparative Sociology, XIV, 1-2 (March-June, 1978) 76-88.

13. Carl R. Rogers, "Toward a Theory of Creativity," in Anderson (ed.), Creativity and Its Cultivation (New York: Harper, 1959)

14. Elton Mayo, The Human Problems of an Industrial Civilization (New York: The Viking Press, 1960).